REMARKS

These remarks are in response to the Office Action dated November 8, 2004. This reply is timely filed. Claims 1-8 are pending in the application. Claims 1-4 and 7-8 were rejected under 35 U.S.C. §102(b). Claims 5-6 were rejected under 35 U.S.C. §103(a). The rejections are set out in more detail below.

I. Brief Review of Applicants' Invention

Prior to addressing the Examiner's rejections on the art, a brief review of applicants' invention is appropriate. The present invention relates to a method for manufacturing embedded capacitors. The method can include the steps of forming at least one bore in a dielectric substrate, and filling the bore with a conductive material to form a first electrode. A conductor that is not electrically continuous with the first electrode also can be formed on the dielectric substrate. A depth and/or cross sectional area of the bore that forms the electrode can be selected to provide a desired amount of capacitive coupling between the electrode and the conductor.

II. Rejections on Art

Claims 1-4 were rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,339,212 to Geffken et al. (hereinafter "Geffken") or U.S. Patent No. 5,055,966 to Smith et al. (hereinafter "Smith"). Claims 7-8 were rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,396,397 to McClanahan et al. (hereinafter "McClanahan"). Finally, claims 5-6 were rejected under 35 U.S.C. §103(a) as being unpatentable over Smith, in view of Examiner's further remark.

Geffken discloses a decoupling capacitor embedded within a semiconductor substrate. The decoupling capacitor utilizes a plurality of tungsten studs and metal interconnects to maximize the surface area of the capacitor, thereby increasing the capacitance of the capacitor. Smith discloses a capacitor structure in a hybrid multilayer circuit. The capacitor structure includes a dielectric fill in a via formed in an insulating layer, a first conductive element overlying the dielectric fill, and a second conductive element underlying the dielectric fill. Finally, McClanahan discloses

dielectric field control layers which are arranged in a layered stack. Capacitors are integrated within the layered stack, and shielding structures are provided to minimize electromagnetic interference (EMI).

Claim 1 recites forming at least one bore in a dielectric substrate and filling the bore with a conductive material to form a first electrode. Claim 1 also recites disposing a conductor on the dielectric substrate such that the conductor is not electrically continuous with the first electrode. Notably, claim 1 further recites that the depth and/or cross sectional area of the bore is selected to provide a desired amount of capacitive coupling between the electrode and the conductor. Both Geffken and Smith fail to disclose this limitation.

Specifically referring to Geffken, rather than disclosing a method to provide a desired amount of capacitive coupling, Geffken is exclusively directed to techniques for maximizing capacitance. For example, Geffken selects a dielectric insulator material to maximize capacitive coupling. Col. 2, lines 60-64. Geffken also discloses the use of tungsten studs and metal interconnects to increase the amount of surface area available for coupling in order to maximize capacitance. Col. 3, lines 45-48. Finally, Geffken discloses that the tungsten studs can be arranged such that only a portion of the tungsten studs overlap metal interconnects, thus again increasing the amount of interconnect area available to form a capacitor's surface area, and thus maximizing capacitance. Col. 3, lines 48-52.

Further, nowhere in his specification does Geffken disclose selecting the depth and/or cross sectional area of the bore as recited in claim 1. Indeed, Geffken is directed to the art of semiconductor substrates. Etching is typically used in such substrates to form vias. With etching it is very difficult to maintain tight tolerances on the physical dimensions of the vias, thus making it extremely difficult to select a depth and/or cross sectional area of a bore (for this reason Geffken focuses on maximizing capacitance rather than achieving a desired amount of capacitance).

It also should be noted that by only disclosing structures that maximize capacitance, Geffken actually teaches away from the present invention. One reading the teachings of Geffken would not see value in selecting bore dimensions that, instead

of maximizing capacitance, can be tailored to provide capacitance values which may be less than the maximum capacitance available.

Smith also fails to disclose selecting a depth and/or cross sectional area of a bore filled with conductive material to provide a desired amount of capacitive coupling. Instead, Smith discloses that larger dielectric via fills can be used (col. 4, lines 15-16). Importantly, dielectric via fills are distinct from the claimed conductive filled bores. In the claimed invention, the depth and/or cross section of the conductive filled bores are selected to vary the size of the electrode (i.e. capacitor plate) and/or the distance between the electrode and an opposing conductor. However, the larger dielectric fill disclosed by Smith would not affect either the size of the electrode or the distance between the electrode and opposing conductor. Instead, more dielectric would increase energy storage between the electrode and conductor (assuming that the permittivity of the dielectric fill is higher than surrounding substrate). At col. 6, lines 16-27 Smith discloses this effect in simplistic terms:

> [r]atioed capacitors (i.e., capacitors whose values have predetermined ratios relative to each other) are readily made with the via capacitors of the invention by appropriately varying the diameter of the vias for the dielectric via fills or utilizing dielectric via fills having different dielectric constants. Thus, for example, for a given dielectric via fill material and the same dielectric via fill thickness, a via capacitor having a dielectric fill via that has twice the area of another capacitor would have a capacitance value that is twice the capacitance value of such other capacitor.

Thus, instead of varying electrode size, Smith increases an amount of dielectric fill to increase capacitance. Accordingly, both Geffken and Smith fail to disclose each of the claim limitations recited in claim 1.

Claim 8 recites a method for manufacturing embedded capacitors comprising forming at least one bore in a first dielectric layer and filling the bore with a conductive material. A first conductor is disposed on the first dielectric layer such that the first conductor is in electrical contact with the first electrode. A second conductor is disposed on a second dielectric substrate. The first and second dielectric layers are joined such that said first and second conductors are not electrically continuous.

Claim 8 further recites that the dimensions of the first conductor and/or the second conductor are selected to provide a desired amount of capacitive coupling between the first conductor and the second conductor. McClanahan fails to teach or suggest this limitation. Instead, McClanahan teaches "[b]y utilizing the a high dielectric field control layer as the dielectric material for an integral capacitor, the capacitor is can be considerably smaller that it would be otherwise for the same capacitance value." Thus, McClanahan teaches that the dielectric material should be selected to achieve a desired capacitance rather than the dimensions of the first and/or second conductor.

Claims 2-7 are believed allowable at least by virtue of their dependence on an allowable base claim.

III. Conclusion

Applicants have made every effort to present claims which distinguish over the prior art, and it is believed that all claims are in condition for allowance. Nevertheless, Applicants invite the Examiner to call the undersigned if it is believed that a telephonic interview would expedite the prosecution of the application to an allowance. In view of the foregoing remarks, Applicants respectfully request reconsideration and prompt allowance of the pending claims.

Respectfully submitted,

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